

## **1.0 INTRODUCTION**

This report has been jointly prepared by the Office of Commercial Space Transportation (OCST) of the Department of Transportation (DOT) and the U.S. Environmental Protection Agency (EPA). This joint effort provides an evaluation of the buildings, equipment, operations and procedures employed at a commercial payload processing facility owned and operated by Astrotech Space Operations (Astrotech), Limited Partnership, in Titusville, Florida. Astrotech's corporate management gave its full cooperation to the evaluation. This report provides an overview of the operations, procedures and methods employed by Astrotech to protect public health and safety, the environment, and public and private property in the Titusville area and presents a summary of the OCST/EPA evaluation team's findings regarding operating procedures, safety policies, and emergency planning and preparedness. However, the safety evaluation team did not examine operations from the standpoint of worker safety, which is regulated by the Occupational Health and Safety Administration (OSHA), nor did they perform a detailed analysis of transportation operations, which are regulated by the Research and Special Programs Administration (RSPA) of DOT. This report can also serve as a general model and guide for the evaluation of similar issues at other existing or proposed facilities that would support the commercial space launch industry.

Payloads (also called spacecraft) are satellites that are launched into space to be used in communications systems, for remote sensing, in weather systems, for planetary exploration and as scientific experiments. Before launch on an expendable launch vehicle (ELV) like the Titan, Delta, or Atlas, or on the Space Shuttle, a payload must be prepared for its mission. The preparations include such things as checking electrical circuits, testing lines or tanks for leaks, and loading liquid propellants into assist motors that will be used once the payload is separated from the launch vehicle and must move itself into a specified orbit and then maintain itself in place while performing its mission. Since these and other preparations must be done under controlled conditions in clean environments (e.g., dust and particulate free) and since some of the materials (i.e., liquid and solid propellant and explosives) that are handled or loaded are hazardous, special facilities were developed by the National Aeronautics and Space Administration (NASA) and the Air Force for these operations. With the growth of the commercial space industry, the ability to process payloads in commercially available facilities is important and Astrotech is the first such commercial payload processing facility.

### **1.1 Background**

The safety evaluation was performed in response to a request by the Lieutenant Governor of the State of Florida, the Honorable Bobby Brantley. In his letter to OCST, dated October 24, 1989,

he indicated that a unique industrial facility existed in Titusville, Florida, owned and operated by Astrotech. This facility provides for the processing and checkout of spacecraft prior to their delivery and launch at either Kennedy Space Center (KSC) or Cape Canaveral Air Force Station (CCAFS). Processing of spacecraft involves a variety of operations as described in Section 4.0.

Under the Commercial Space Launch Act of 1984, as amended (Public Law 98-575, 100-657), the U.S. Department of Transportation (DOT) is responsible for licensing and regulating U.S. commercial space launch activities in a manner that protects public safety, safety of property, and U.S. national security and foreign policy interests, and encourages development of a viable domestic commercial launch industry. When questions arose concerning the safety of Astrotech's activities, the Lieutenant Governor of Florida requested OCST to conduct an impartial and focused review of the payload processing facility and operations. Because activities at Astrotech could affect safety of licensed launch operations, OCST agreed to undertake the safety evaluation.

OCST conducted an initial fact-finding visit and interviewed individuals from Astrotech, the City of Titusville, Brevard County, the Florida Department of Environmental Regulation (DER) and the Air Force to identify the potential issues involved with the safety evaluation. As a result of this visit, OCST determined that many of the safety evaluation issues involved areas in which EPA has recognized expertise. Since EPA has an on-going chemical safety audit program that addresses emergency planning and preparedness requirements, inclusion of EPA in a joint OCST/EPA effort has provided a more thorough and insightful review and evaluation.

## **1.2 Overview**

In the early 1980's, with the growing opportunity for commercial access to space via the NASA's shuttle program and various ELVs, it was believed that the capacity for launch services support provided by the Government was inadequate to meet the growing needs of the commercial spacecraft community. Astrotech designed and built a commercial facility near KSC and CCAFS, which would provide state-of-the-art payload processing and support capabilities to those payload customers that had been using the NASA-owned facilities at KSC. NASA and Astrotech entered into a formal Memorandum of Understanding (MOU) whereby NASA agreed to accept payloads processed at Astrotech as long as they complied with NASA safety and other requirements. Astrotech also compiled and presented site selection information, services to be offered, design concepts and contracting considerations to spacecraft manufacturers, owners and contractors to elicit comments. The responses were then used, as appropriate, in designing, developing and constructing the Astrotech facility in Titusville, Florida.

The Astrotech complex in Titusville contains six major buildings located on approximately 37 acres in an industrial park, 2.75 miles from the Gate 3 entrance to KSC. The facility provides space and limited support for payload customers (U.S. and foreign) to perform the final assembly, checkout, fueling, and telemetric control of their spacecraft. The buildings are physically separated into hazardous and non-hazardous operations areas, based on the materials handled during the operations. Building 2, the Hazardous Processing Facility, is located several hundred feet from the rest of Astrotech's buildings and is constructed to meet Department of Defense (DoD) and Bureau of Alcohol, Tobacco, and Firearms (ATF) explosives siting standards.

Astrotech provides, through a fixed-price agreement with a payload customer, approximately the same support services as those provided by NASA through its Space Transportation System (STS) Optional Services Package. Services include ancillary support to the payload customer, local transportation of propellants to and from KSC/CCAFS for spacecraft fueling, transportation of the processed payload to the launch site, and off-load and on-load of spacecraft parts and other support equipment, as needed. All hazardous operations performed at Astrotech are directly supervised by the Astrotech Safety Officer. In order to provide comprehensive services, Astrotech subcontracts with NASA to provide limited routine support including propellant storage, cold soak and x-ray of rocket motors and chemical analysis of liquid propellants.

The payload customer is responsible for, and performs all hands-on work related to the assembly, processing, and fueling of the spacecraft; all of which requires highly trained, specialized personnel. The payload customer conducts these activities because the investment in the spacecraft is so great (on the order of \$100 million or more) that stringent control measures are required. The value of a typical spacecraft may be five to ten times greater than that of the entire Astrotech facility, estimated to cost approximately \$15 to \$20 million.

### **1.3 Data Gathering and Analysis**

This evaluation involved a visit to the Astrotech Titusville payload processing facility to examine buildings and equipment, to assess policies and procedures encompassing the overall safety program at Astrotech, and to evaluate the protection afforded to the public by the program in place. Specific information was gathered concerning the following:

- Buildings
- Operations and equipment
- Hazardous materials handled on-site
- Safety systems and equipment (including detection and monitoring systems)
- Emergency preparedness and planning

The on-site visit allowed the OCST/EPA team to examine buildings, equipment, and safety systems used for hazardous operations as well as the chance to view hazardous operations, interview key Astrotech safety personnel and to review relevant documents, reports, design drawings, regulatory permits, and other pertinent information. The visit also afforded the OCST/EPA team members the opportunity to meet with the local emergency response authorities, the local emergency planning committee (LEPC), and the Brevard County Emergency Management Agency to discuss the status of the emergency response and planning activities for the Astrotech facility and to identify and characterize the strengths and weaknesses of Astrotech's specific safety and accident prevention programs.

Following the data gathering phase, the team members analyzed data, evaluated safety systems, performed hazard analyses and determined risk to the public from various potential accident scenarios. Additional questions were asked of Astrotech personnel on an as needed basis, and Astrotech reviewed selected draft sections of this report to ensure that the safety evaluation team had accurately represented the facility's features and operations.

#### **1.4 Evaluation Report**

The results of the extensive data gathering and evaluation processes are presented in this report. While this safety evaluation will not ensure that an accident never happens at Astrotech, this process can help to identify any potentially hazardous situations that may exist, and highlight areas within the facility where operational or safety system improvements might significantly reduce hazards to the public. This report may also provide state and local emergency response agencies with guidance for dealing with safety issues concerning these and other space-related activities, as well as an approach to learning about and sharing technologies, techniques, and management practices dealing with safety and emergency preparedness.

The remainder of the report is organized into the following sections:

Section 2.0	Executive Summary
Section 3.0	Site Overview
Section 4.0	Buildings and Operations
Section 5.0	Safety Policies and Requirements
Section 6.0	Emergency Preparedness and Planning
Section 7.0	Hazard Analyses and Risk Assessment
Section 8.0	Findings, Recommendations and Guidance

Several appendices are also included with more detailed information regarding items such as Astrotech's Florida DER air permit, safety equipment specifications, references for information on performing hazards analyses, and the Brevard

County Hazards Analysis.

